<u>REMARKS</u>

The Examiner in the office action rejected claims 1, 2, 10, 12, 13, 15, 17-19, 21, 23-25, 48-52, 57, 61, and 62 under 35 U.S.C. § 103(a) as being unpatentable over *Horstmeyer et al.* '814 in view of *Thomeer et al.* '003. Claims 17, 19, 20, 55, 56, 68-70 and 72-74 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Pringle et al.* '951 in view of *Thomeer et al.* Claims 3, 7, and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Horstmeyer et al.* '814 as modified by *Thomeer et al*, as applied to claim 1, further in view of *Williams et al.* '337. Claims 22, 59, and 60 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Horstmeyer et al.* '814 as modified by *Thomeer et al*, as applied to claim 21, further in view of *Colin et al* '145. Claims 53 and 58 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Horstmeyer et al.* '814 as modified by *Thomeer et al*, as applied to claims 17 and 21 respectively, further in view of *Wu* '267. Claim 54 was rejected under 35 U.S.C. § 103(a) as being unpatentable over *Pringle et al.* '951 as modified by *Thomeer et al*, as applied to claim 17, further in view of *Dismukes* '856. Claims 64-67 and 71 were objected to as being dependent upon a base rejected claim. Although not mentioned in the office action, Applicant assumes that the objection in the last office action to the Abstract and the rejection of claim 58 under 35 U.S.C. § 112, second paragraph, were overcome by Applicant's Response dated August 23, 2002.

Applicant acknowledges with appreciation the allowance of claims 33-35 and 38-47. Claims 64 and 65 have been rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 66, 67, and 71 depend from claim 65. Thus, claims 64-67 and 71 are now in allowable form.

Claims 1, 2, 10, 12, 13, 15, 17-19, 21, 23-25, 48-52, 57, 61 and 62 are rejected under § 103(a) as being unpatentable over *Horstmeyer et al.* in view of *Thomeer et al.* Applicant traverses this rejection because it is not obvious to use the fluid conveying tubing of *Thomeer et al* as the drilling umbilical in *Horstmeyer et al.*

Horstmeyer et al. discloses a coilable umbilical 14 which is connected at its upper end to an electronic processor 15 and is connected at its lower end to a drilling tool assembly 21. The drilling tool assembly 21 includes a cutter head 36, a first thruster assembly 39, hydraulic motors 40, a first hydraulic ram assembly 42, a first anchor assembly 44, a downhole sensing device 46, a second hydraulic ram assembly 48, a second anchor assembly 50, a second thruster assembly 52, a coupling U-joint 54, a hydraulic system control device 56, a hydraulic pump 58, an electric motor 60, and a hydraulic reservoir 61, all as shown in Figure 3 of *Horstmeyer et al.* The hydraulic motors 40 and the first and second anchor and ram units 62, 63 are powered by hydraulic fluid controlled by control

device 56 and supplied by hydraulic pump 58 with the hydraulic fluid being supplied from hydraulic reservoir 61. Hydraulic pump 58 is driven by electric motor 60. The direction of drilling can be altered by thruster assemblies 39, 52. *Horstmeyer et al.* emphasizes that down hole drill tool system 21 is a self-contained hydraulically powered unit and that the first and second anchor and ram units 62, 63, first and second thruster assemblies 39, 52, and hydraulic motors 40 are powered by hydraulic fluid, and not circulating fluids, to avoid contamination. (See Col. 2, l. 44-46 and Col. 3, l. 1-4). The umbilical 14 includes an inner drilling fluid supply hose 30 and an outer heat shrinkable abrasive proof tubing 33. Lifting cables 22, control wire 24, instrumentation wires 26, a power cable 28 and a hydraulic reservoir make up hose 34 are wrapped in a spiral or straight fashion about inner hose 30 with the void spaces between the inner hose 30 and outer tubing 33 being filled with a plastic 32.

The Examiner states that *Horstmeyer et al.* does not teach fibers wrapped in a predetermined pattern around a liner to form a composite tube and does not teach a composite tube with the fibers carrying axial/tension loads. The Examiner suggests that it would be obvious to replace the *Horstmeyer et al.* umbilical with the composite fluid conveying tubing of *Thomeer et al.* '003.

Thomeer et al. '003 discloses a composite coiled tubing apparatus including a downhole tool 20 connected to a composite coiled tubing 16. The downhole tool 20 may be used to conduct flow or measurements or perhaps to provide diverting fluids. (Col. 6, ll. 8-11). The composite coiled tubing apparatus is particularly directed to the treating of wells. (Col. 8, ll. 16-22; col. 12, ll. 3-9). The composite coiled tubing 16 includes a plurality of fiber layers 77, 78, and 79 which provide a weave around a solid liner 76 which is made of plastic. The fibers are engineered such that the coiled tubing has a section modulus and section properties which vary along the length of the coiled tubing so that predetermined characteristics of the coiled tubing including stiffness or strength may be varied. (Col. 21, l. 50-53; col. 22 l. 20-24 and l. 50-56; col. 24 l. 5-10). Conducting wires 107, 108 may be located outside the inner solid liner layer 76. The wires may be used to either communicate with downhole tools or to receive data from downhole tools. (Col. 3, ll. 50-55; col. 3, l. 66 through col. 4, l. 1; col. 8, ll. 48-51; col. 11, ll. 10-29; col. 12, ll. 43-45). In one example, four individual 28 gauge insulated copper wires are installed in the laminate to provide communications capability. (Col. 15, ll. 5-8). *Thomeer et al.* '003 does not teach embedding an electrical conductor in the wall of the composite coiled tubing for providing electrical power downhole. Further, *Thomeer et al.* '003 does not teach conveying fluid downhole to provide power to a propulsion system.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference

teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references, when combined, must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. When the motivation to combine the teachings of the references is not immediately apparent, it is the duty of the examiner to explain why the combination of the teachings is proper. The ultimate determination of patentability is based on the entire record, by a preponderance of evidence, with due consideration to the persuasiveness of any arguments and any secondary evidence.

There is no suggestion or motivation to combine the teachings of *Thomeer et al.* with those of *Horstmeyer et al. Thomeer et al.* teaches a composite coiled tubing apparatus and method for conveying fluids downhole in a wellbore, as for example, to treat the well while *Horstmeyer et al* teaches a drill string. The objectives and functional requirements between fluid conveying tubing and drill strings are different. They have different uses and are subject to completely different loads. Fluid conveying tubing is static while drill strings are dynamic. Fluid conveying tubing merely extends from the surface down into the well adjacent the producing formation for conveying fluids down into the wellbore and into the formation. As discussed at Col. 1, l. 51 through Col. 2, l. 38; Col. 6, l. 47 through Col. 7, l. 11; and Col. 16 l. 12-67, the composite coiled tubing is pushed into and out of the well by a coiled tubing injector. The *Thomeer et al.* tubing is not designed for use with a propulsion system which pulls the tubing into the well. Therefore the *Thomeer et al.* tubing is not designed for the drilling assembly of *Horstmeyer et al.* The fibers of the *Thomeer et al.* tubing are engineered such that the coiled tubing has a section modulus and section properties which vary along the length of the coiled tubing so that predetermined characteristics of the coiled tubing including stiffness or strength may be varied to avoid the problems of buckling and lock up of the coiled tubing as it is being pushed down into the well.

The *Thomeer et al.* tubing can be engineered with such precision because the depth of the formation is known for the fluid treatment of the formation. Because the depth is known, the composite coiled tubing string may be custom designed for a particular tubing string length with its section modulus and section properties varying in a known manner along the length of the coiled tubing to comport with the characteristics of the borehole. In drilling, the tubing string cannot be

precisely engineered because the length and loads on the tubing vary with the depth of the propulsion system as the borehole is being drilled.

Further, the tension and compression loads are completely different. The tension loads on the fluid conveying tubing of *Thomeer et al.* need only support its own weight and the weight of the downhole tool. A drill string, on the other hand, must not only support its own weight and a heavier bottom hole assembly but also must withstand the tension applied by the propulsion system as it pulls the tubing string into the well during drilling. The fluid conveying tubing string of *Thomeer et al.* is designed to withstand compression because it is pushed into the well while the umbilical of *Horstmeyer et al.* is designed to withstand tension loads caused by the pulling of the propulsion system. Further, a non-metal drill string does not rotate during drilling and thus the bottom hole assembly must include a downhole motor, bit and other components such as a propulsion system as in *Horstmeyer et al.* Thus, a bottom hole assembly has considerable more weight than a downhole tool for treatment fluids. Further the drill string must withstand the dynamic forces caused by the drilling operation including the loads applied by the bit, downhole motor and the propulsion system. Tensile loads on the drill string can be as much as 20,000 to 30,000 psi. Further, the drill string must also be more rugged because it must pass through open borehole in multiple trips into the well while a fluid conveying tubing passes through a cased borehole in a single trip into the well. For all these reasons, one skilled in the art would not use fluid conveying tubing of *Thomeer et al* as the drill string in *Horstmeyer et al.*

The composite coiled tubing of *Thomeer et al.* is used only to convey fluids downhole and need only withstand the pressures caused by the surface pumps pumping the fluid downhole and the hydrostatic head of the fluid. A drill string must withstand the internal pressures caused by the drilling fluid flowing through the flowbore of the drill string to power a downhole motor, force fluid through nozzles in the bit, and flow cuttings to the surface. Still further, there are pressures applied on the drill string from the annulus around the drill string.

Since *Horstmeyer et al.* does not use the internal drilling fluid supply hose 30, heat shrinkable abrasion tubing 33, or filler plastic 32 to carry the loads placed on the drilling umbilical but instead relies upon lifting cable 22, if one skilled in the art wanted a substitute to carry the loads on a drilling umbilical, one skilled in the art would look for a substitute for the lifting cable 22 and not a substitute for tubular members 30, 33. If one skilled in the art were to look for a substitute for tubular members 30, 33, one skilled in the art would not consider the teachings of *Thomeer et al.* since the fluid conveying tubing of *Thomeer et al.* is not used for drilling. Therefore, if one skilled in the art were to look for a substitute for the *Horstmeyer et al.* drilling umbilical, there is no

suggestion, motivation or reason to believe that one skilled in the art would consider the *Thomeer et al.* fluid conveying tubing.

With respect to claim 1, as amended, neither *Horstmeyer et al.* nor *Thomeer et al.* teaches the claimed composite tube having a modulus which does not vary along the length of the composite tube.

Claims 2, 10, 12, 13, 15, and 48-52 are allowable as claiming a patentable system in combination with the elements of claim 1. With respect to claim 2, neither reference teaches a composite tube to achieve substantial neutral buoyancy. With respect to claim 10, as amended, the cited prior art does not teach a fiber reinforced matrix forming a modulus which does not vary along the length of the composite tube. With respect to claims 12 and 13, neither reference teaches placing an electrical conductor adjacent the load carrying fibers. *Thomeer et al.* does not convey electrical power downhole but only conveys signals for communication with the surface. With respect to claim 15, *Horstmeyer et al.* does not teach a specific passageway through the drill tool assembly 21 for the flow of fluid. *Horstmeyer et al.* states that drilling fluid is pumped through umbilical 14 and passes the drill tool assembly 21 and cutter head 36 to remove cuttings (see col. 7, l. 14-18). It is not clear how *Horstmeyer et al.* intends for drilling fluids to pass the drill tool assembly 21. Further, *Horstmeyer et al.* teaches a path for return drilling fluid within the drilling tool assembly 21 (see col. 10, l. 9-11). With respect to claims 48-50, neither reference teaches a wear layer or pressure layer around the load carrying layers of fibers. With respect to claim 51, *Horstmeyer et al.* does not teach powering a propulsion system with fluids circulating through the liner. With respect to claim 52, *Horstmeyer et al.* does not teach a single housing with traction modules.

With respect to claim 17, *Thomeer et al.*. does not teach a composite tube having a power conductor to provide power to an attached bottom hole assembly. *Thomeer et al.*. does not convey electrical power downhole but only conveys signals for communication with the surface. Neither reference teaches a power conductor disposed adjacent fibers in the pipe. Claims 18-19 are allowable as claiming a patentable apparatus in combination with the elements of claim 17. With respect to claim 18, *Horstmeyer et al.* does not teach a bottom hole assembly for a non-drilling well apparatus. With respect to claim 19, *Horstmeyer et al.* does not teach a propulsion system powered by drilling fluids.

Claim 21 is allowable for the same reasons as expressed with respect to claims 15 and 17. *Thomeer et al.* does not teach a composite tube having a power conductor to provide power to an attached bottom hole assembly. *Thomeer et al.* does not convey electrical power downhole but only

conveys signals for communication with the surface. Neither reference teaches a power conductor disposed adjacent fibers in the pipe.

Claims 23-25, 57, 61 and 62 are allowable as claiming a patentable apparatus in combination with claim 21. With respect to claim 23, neither cited reference teaches a steering assembly having a actuator to adjust the bend angle and angular orientation of the bend angle between the formation displacing member and bottom hole assembly. With respect to claim 24, *Horstmeyer et al.* does not teach a propulsion system powered by drilling fluids. With respect to claim 25, as amended, *Thomeer et al.* does not teach the claimed composite tube having a modulus which does not vary along the length of the composite tube. With respect to claim 57, the cited prior art does not teach a bottom hole assembly with a central flow passage about the axis of the assembly. With respect to claim 61, *Horstmeyer et al.* does not teach an electrically actuated steerable assembly. With respect to claim 62, the cited references do not teach the claimed steerable assembly such as having spacer members.

Claims 17, 19, 20, 55, 56, 68-70, and 72-74 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Pringle et al.* '951 in view of *Thomeer et al.* There is no suggestion or motivation to combine the teachings of *Thomeer et al.* with those of *Pringle et al.* *Thomeer et al.* teaches a fluid conveying non-metallic tubing for conveying fluids downhole in a wellbore, as for example, to treat the well while *Pringle et al.* teaches a metal coiled tubing drill string. The objectives and functional requirements between fluid conveying tubing and drill strings are different. They have different uses and are subject to completely different loads. Fluid conveying tubing is static while drill strings are dynamic. Fluid conveying tubing merely extends from the surface down into the well adjacent the producing formation for conveying fluids down into the wellbore and into the formation. As discussed at Col. 1, l. 51 through Col. 2, l. 38; Col. 6, l. 47 through Col. 7, l. 11; and Col. 16 l. 12-67, the composite coiled tubing is pushed into and out of the well by a coiled tubing injector. The *Thomeer et al.* tubing is not designed for use with a thruster system which pulls the tubing into the well. Therefore the *Thomeer et al.* tubing is not designed for the drilling assembly of *Pringle et al.* The fibers of the *Thomeer et al.* tubing are engineered such that the coiled tubing has a section modulus and section properties which vary along the length of the coiled tubing so that predetermined characteristics of the coiled tubing including stiffness or strength may be varied to avoid the problems of buckling and lock up of the coiled tubing as it is being pushed down into the well.

The *Thomeer et al.* tubing can be engineered with such precision because the depth of the formation is known for the fluid treatment of the formation. Because the depth is known, the

composite coiled tubing string may be custom designed for a particular tubing string length with its section modulus and section properties varying in a known manner along the length of the coiled tubing. In drilling, the tubing string cannot be precisely engineered because the length and loads on the tubing vary with the depth of the propulsion system as the borehole is being drilled.

Further, the tension and compression loads are completely different. The tension loads on the fluid conveying tubing of *Thomeer et al.* need only support its own weight and the weight of the downhole tool. A drill string, on the other hand, must not only support its own weight and a heavier bottom hole assembly but also must withstand the tension applied by the thruster system as it pulls the tubing string into the well during drilling. The fluid conveying tubing string of *Thomeer et al.* is designed to withstand compression because it is pushed into the well while the tubing string of *Pringle et al.* is designed to withstand tension loads caused by the pulling of the thruster system. Further, a non-metal drill string does not rotate during drilling and thus the bottom hole assembly must include a downhole motor, bit and other components such as a thruster system as in *Pringle et al.* Thus, a bottom hole assembly has considerable more weight than a downhole tool for treatment fluids.

Further the drill string must withstand the dynamic forces caused by the drilling operation including the loads applied by the bit, downhole motor and the thruster system. Tensile loads on the drill string can be as much as 20,000 to 30,000 psi. Further, the drill string must also be more rugged because it must pass through open borehole in multiple trips into the well while a production tubing passes through a cased borehole in a single trip into the well. For all these reasons, one skilled in the art would not use fluid conveying tubing of *Thomeer et al* as the drill string in *Pringle et al.*

Still further metallic and non-metallic coiled tubing strings are different. It would not be obvious to substitute a non-metallic production tubing for a metallic coiled tubing drill string for many of the same reasons expressed in the above paragraph. For example, *Pringle et al.* includes an orienting tool 48 to rotate the tool face. A first portion 50 of tool 48 is attached to the coiled tubing 20 and a second portion 52 is connected to the bottom hole assembly components. Thus to rotate the tool face, orienting tool 48 rotates the second portion 52 with respect to the first portion 50. However, the coiled tubing must hold the first portion stationary so that the second portion 52 can rotate the tool face. A composite coiled tubing can not withstand the torque of this relative rotation and therefore could not hold the first portion 50 stationary. For these reasons, one skilled in the art would not use the fluid conveying tubing of *Thomeer et al.* for the drill string of *Pringle et al.*

Further with respect to claim 17, *Thomeer et al.* does not teach a composite tube having a power conductor to provide power to an attached bottom hole assembly. *Thomeer et al.* does not

convey electrical power downhole but only conveys signals for communication with the surface. Neither reference teaches a power conductor disposed adjacent fibers in the pipe.

Claims 19-20, 55-56, 68-70 and 72-74 are allowable as claiming a patentable apparatus in combination with claim 17. Further with respect to claim 19, *Pringle et al.* does not teach a propulsion system for moving the drill string. Further with respect to claim 20, *Pringle et al.* does not teach a steering apparatus which changes bend angle and angular orientation of the bend angle of the bit at an articulated joint. Further with respect to claim 55, *Pringle et al.* at Col. 4, lines 33-35, refers to U.S. Patent 5,316,094 for details of thruster 40. The '094 patent describes a hydraulic line extending to the surface to supply fluid to the thruster. Drilling fluids are not used. Further with respect to claim 56, *Pringle et al.* does not teach a three dimensionally, angularly adjustable joint at the steering apparatus. Wit respect to claim 68, the cited references do not teach the recited range of modulus which does not vary along the length of the string. With respect to claim 69, the cited references do not teach the recited determination of the modulus of elasticity in the axial direction. With respect to claim 70, the cited references do not teach the specific modulus of elasticity in the axial direction. *Thomeer et al.* teaches a coiled tubing having a section modulus and section properties which vary along the length of the coiled tubing so that predetermined characteristics of the coiled tubing including stiffness or strength are varied to avoid the problems of buckling and lock up of the coiled tubing as it is being pushed down into the well. With respect to claim 72, the cited references do not teach the determination of spoolable composite pipe. With respect to claim 73, the cited references do not teach a density substantially the same as that of the wellbore fluids. With respect to claim 74, the cited references do not teach the recited range of specific gravity.

Claims 3, 7, and 11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Horstmeyer et al.* as modified by *Thomeer et al.*, as applied to claim 1, further in view of *Williams et al.* '337. Claims 3, 7, and 11 are allowable as claiming a patentable apparatus in combination with claim 1. With respect to claim 3, *Williams et al.* at Col. 3 l. 4-10 teaches a typical plastic matrix material used in a composite tube having a modulus of elasticity of between 100,00 and 500,00 psi. or greater and at Col. 4, l. 27-29 teaches a plastic binder in which the fibers are embedded to form a matrix having a modulus of elasticity that exceeds 100,000 psi. Such disclosures do not teach a <u>composite tube</u> having a modulus of elasticity in the range of 500,000 to 10,500,000 psi which has a which does not vary along the length of the coiled tubing. With respect to claim 7, the cited prior art does not teach a composite tube having a density which achieves a neutral buoyancy. With respect to claim 11, the cited prior art does not teach embedding an electrical power conductor non-axially in such a composite tube.

Claims 22, 59, and 60 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Horstmeyer et al.* as modified by *Thomeer et al.*, as applied to claim 21, further in view of *Colin et al.* Claims 22, 59, and 60 are allowable as claiming a patentable apparatus in combination with claim 21. With respect to claims 22, 59 and 60, there is no suggestion or motivation to combine the teachings of *Colin et al* with those of *Horstmeyer et al.* or *Thomeer et al. Colin et al.* is a connection device for cable and not for composite coiled tubing used in the oilfield. With respect to claims 59 and 60, as amended, *Colin et al.* does not teach seals sealingly engaging upon the mating of the cooperative surfaces to provide a hydraulic seal around the power conductor. *Colin et al.* does not teach seals or a power conductor.

Claims 53 and 58 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Horstmeyer et al.* as modified by *Thomeer et al.*, as applied to claim 17, further in view of *Wu* '267. Claims 53 and 58, as amended, are allowable as claiming a patentable apparatus in combination with claim 17. With respect to claims 53 and 58, the cited references do not teach a resistivity antenna disposed in a propulsion system.

Claim 54 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Pringle et al.* '951 as modified by *Thomeer et al.*, as applied to claims 17, further in view of *Dismukes* '856. Claim 54 is allowable as claiming a patentable apparatus in combination with claim 17. With respect to claim 54, the cited prior art does not teach engineering the fibers in the string so as to achieve substantially neutral buoyancy.

During the course of these remarks, Applicant has at times referred to particular limitations of the claims which are not shown in the applied prior art. This short-hand approach to discussing the claims should not be construed to mean that the other claimed limitations are not part of the claimed invention. They are as required by law. Consequently, when interpreting the claims, each of the claims should be construed as a whole, and patentability determined in light of this required claim construction. Unless Applicant has specifically stated that an amendment was made to distinguish the prior art, it was the intent of the amendment to further clarify and better define the claimed invention.

If the Examiner has any questions or comments regarding this communication, he is invited to contact the undersigned to expedite the resolution of this application.

Reconsideration of the claims as amended and the allowance thereof is respectfully requested.

Respectfully submitted,

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